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SUBJECT TO REVISION

BASS LAKE, STARKE COUNTY AQUATIC PLANT MANAGEMENT PLAN UPDATE 2007

PREPARED FOR:

BASS LAKE CONSERVANCY DISTRICT
3620 SOUTH COUNTY ROAD 210
KNOX, IN 46534

PREPARED BY:

V3 Companies, Ltd.
7325 JANES AVENUE
WOODRIDGE, IL 60517
630.724.9200

DECEMBER 14, 2007

Executive Summary

Bass Lake Conservancy District contracted V3 Companies Ltd. (V3) to complete aquatic vegetation sampling in order to update an aquatic vegetation management plan which was created in 2004. The update was funded as part of the Lakes and River Enhancement fund (LARE) which was obtained by the Bass Lake Conservancy District and the Indiana Department of Natural Resources (IDNR) Division of Fish and Wildlife. Funding for the LARE program is provided by an annual fee charged to boat owners. This update will also serve as a prerequisite to continue LARE program funding to control exotic or nuisance species.

Bass Lake is a 1,400-acre natural lake located five miles southeast of Knox, Indiana in Starke County. Aquatic plants are the foundation of healthy and sustainable lake ecosystems. In order to protect diverse and stable communities of native aquatic plants it is vital to prevent the spread of invasive aquatic plants. The purpose of an Aquatic Plant Management Plan is to identify aquatic weed problem areas, describe management objectives, prescribe management strategies, and determine funding needs and sources necessary for the control of invasive aquatic plants. Bass Lake's primary nuisance species is Eurasian watermilfoil. Eurasian watermilfoil grows and reproduces rapidly, and often displaces native species, degrades biodiversity, impedes recreational uses, and reduces real estate and aesthetic values.

In Bass Lake, Eurasian watermilfoil has negatively impacted boating, fishing, and swimming. The primary goal of the Bass Lake Conservancy District is to reduce the impact of Eurasian watermilfoil while preserving and enhancing native plant communities. In the original plan, it stated the best means of controlling Eurasian watermilfoil would be a whole lake fluridone treatment. IDNR permitted this type of treatment and Weed Patrol performed a whole lake treatment application of 7 parts per billion (ppb) on May 14, 2007. A second treatment of 3 ppb, or bump, was applied on June 15, 2007 in order to maintain the fluridone concentration within the lake. This type of treatment will likely provide multiple years of Eurasian watermilfoil control and allow native vegetation to re-establish. It is the recommendation of this plan that the Bass Lake Conservancy District pursue funds to conduct follow-up monitoring and treatments in 2008. Detection of new Eurasian watermilfoil locations will be a primary focus in future management.

Acknowledgements

We would like to acknowledge Gwen White and Angela Sturdevant with IDNR's LARE program for providing funding and assistance in the completion of this study. We would like to recognize Bob Peterson, IDNR District Fisheries Biologists, for consultation and information. We would like to acknowledge the Bass Lake Conservancy District as the local sponsor that provided assistance and guidance including Joseph Carey and Cinndi Carey. We would like to recognize Tony Cunningham and Leslie Cunningham for their mapping, recommendation, and consultation. Finally we would like to acknowledge V3 staff involved in the research, sampling, and document preparation including: Juli Mason, Wally Levernier, Desiree Poole, Amy Halsall, Jessica Dunn and Ed Belmonte.

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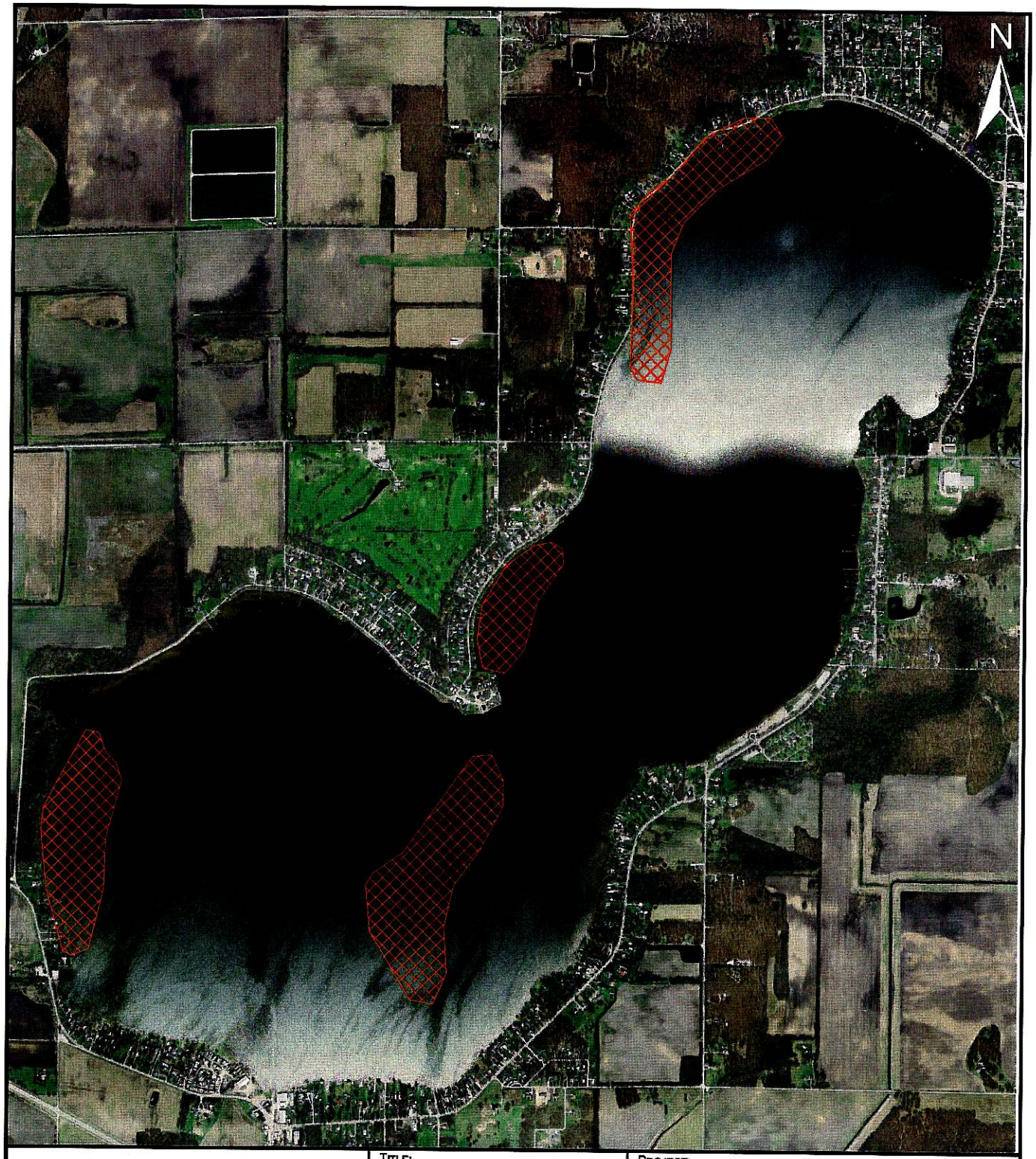
Introduction and Background

Bass Lake is a 1,400-acre natural lake in Starke County, Indiana and is located five miles southeast of Knox. Bass Lake has a maximum depth of 30 feet and an average depth of 3.5 feet. The overall Bass Lake watershed is 3,060 acres. Bass Lake itself covers almost half of the watershed (47%). Much of the remaining portion of the watershed is forested (21%) or utilized for residential (15%) or agricultural (9.5%) purposes (J.F. New, 2002).

Bass Lake is used heavily for swimming, boating and fishing. There is a state owned public access on the southwest shore. There is also handicapped-accessible camping, picnic, and Bass Lake State Beach.

Eurasian watermilfoil is an aggressive invasive aquatic species that can have a detrimental effect on the native aquatic plant community, provides poor fish habitat, inhibits boat navigation, and causes annoyances and serious health hazards to swimmers, and other members of the general public who wish to enjoy the lake. Pre-treatment distribution of Eurasian watermilfoil within Bass Lake is seen in Exhibit I.

This report was created in order to update the Bass Lake Aquatic Vegetation Management Plan 2005, which was funded by the IDNR LARE program and the Bass Lake Conservancy District. This report will serve as a tool to track changes in vegetation community, monitor for invasive or nuisance species, to adjust the action plan, and to maintain eligibility for any additional LARE funding. Topics covered in this update include the 2007 sampling results, a review of the 2007 vegetation controls, and updates to the budget and action plans. Once reviewed and approved, this report will serve as an update to the Aquatic Vegetation Management Plan 2006 Update.



V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: **Pre-treatment Distribution of Eurasian Watermilfoil**		PROJECT: **Bass Lake Aquatic Plant Management Plan**	
BASE LAYER: Indiana Spatial Data 2006 Orthophotography	PROJECT NO. 07122	EXHIBIT: I	SHEET: 1 OF: 1
CLIENT: Bass Lake Conservancy District 3620 South CR 210 Knox, IN 46534	QUADRANGLE: Starke	DATE: 12/12/07	SCALE: 1"=20500'

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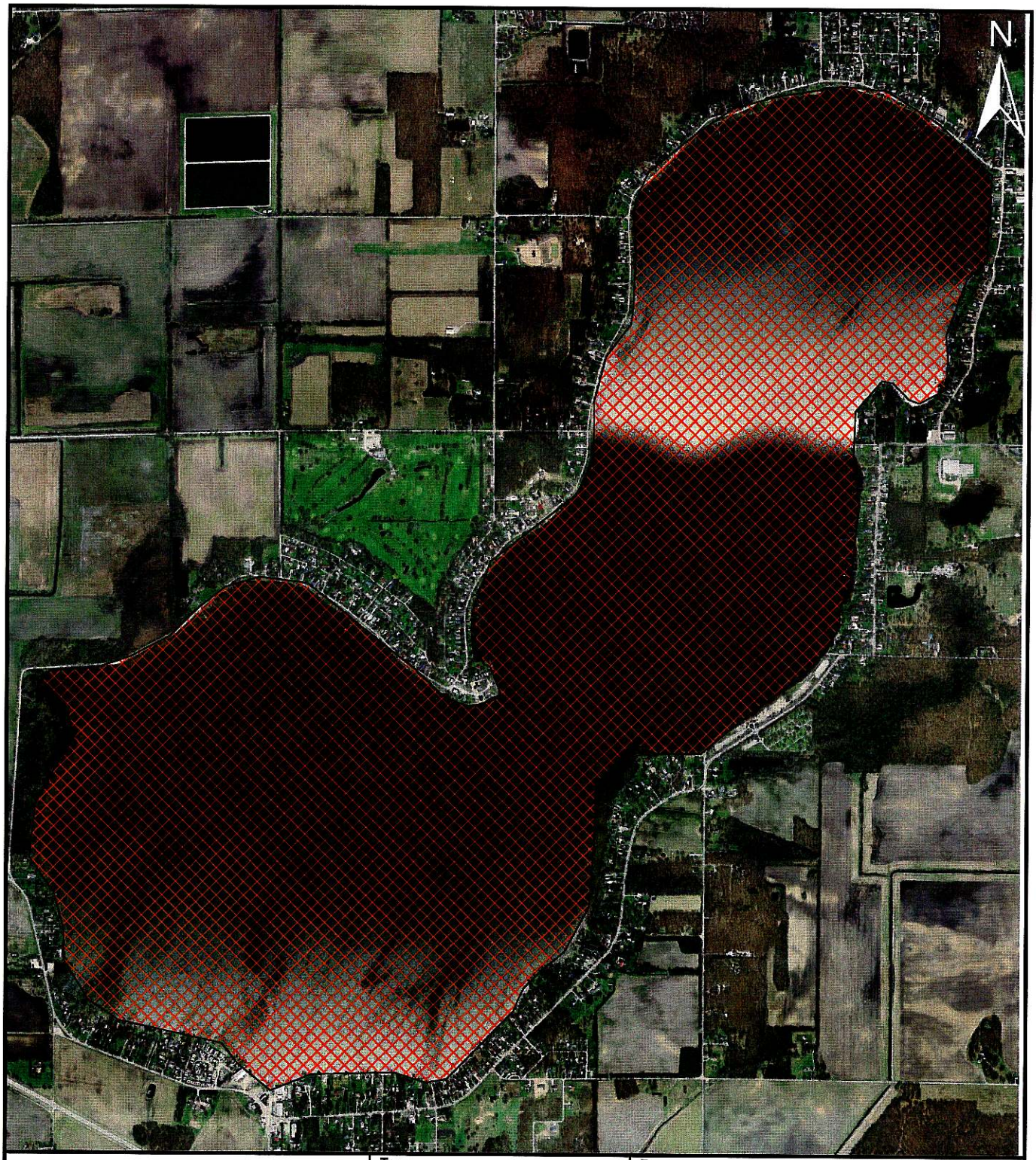
Problem Statement

In part due to water quality problems, Eurasian watermilfoil infested Bass Lake. As a shallow lake with a long fetch, Bass Lake is naturally susceptible to poor water clarity due to continual mixing of the bottom sediments within the water column. Power boating on Bass Lake only compounds the problem. Yousef et al. (1978) found that energy from a 75-hp motor can displace sediments as deep as 8 feet (2.4 m), which is greater than the average depth in Bass Lake. Bass Lake is also used heavily for boating which fragments Eurasian watermilfoil and allows for growth in new areas. A combination of conditions within Bass Lake and recreational uses of the lake create the perfect environment for Eurasian watermilfoil to flourish.

Eurasian watermilfoil is an aggressive, invasive aquatic species that can have a detrimental effect on the native aquatic plant community. This nuisance species grows and spreads rapidly, forming dense weed beds that outcompete native species for light and nutrients. In lakes where Eurasian watermilfoil is left unchecked, even well-diversified plant communities can become decimated and taken over by a single species.

Bass Lake was treated with a Sonar aquatic herbicide on May 14, 2007 (Exhibit II). Treatments on Bass Lake should be continued over the next two to three years, targeting areas of new growth, to ensure Eurasian watermilfoil doesn't become the dominant species within Bass Lake.



V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: **Bass Lake Sonar Treatment Area**	PROJECT: **Bass Lake Aquatic Plant Management Plan**		
BASE LAYER: Indiana Spatial Data 2006 Orthophotography	PROJECT NO. 07122	EXHIBIT: II	SHEET: 1 OF: 1
CLIENT: Bass Lake Conservancy District 3620 South CR 210 Knox, IN 46534	QUADRANGLE: Starke	DATE: 12/12/07	SCALE: 1"=20500'

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Sampling Results 2007

On August 6, 2007 a Tier II survey was conducted on Bass Lake. The Tier II Aquatic Vegetation Survey Protocol, designated by the IDNR, serves as a standardized method to document the distribution and abundance of aquatic vegetation within selected areas and a state scale. The information collected can be used to compare present distribution and abundance to past and identify current trends within the lakes. A table outlining the scientific and common names of species collected or observed in Bass Lake is listed below (Table 1).

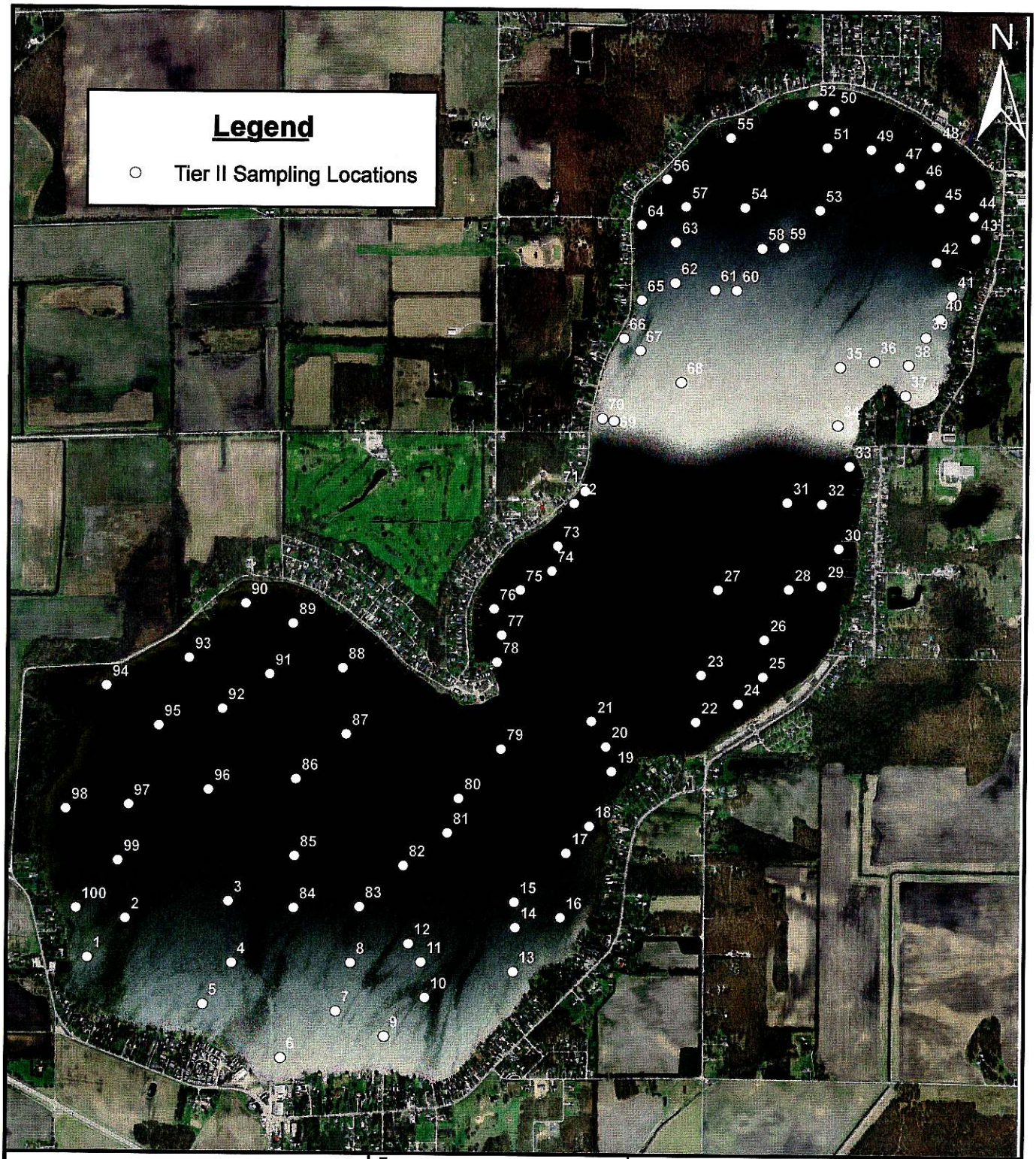
Table 1. Scientific and common names of species collected in Bass Lake.

Scientific Name	Common Name
Chara sp.	chara
Justicia Americana	water willow
Myriophyllum spicatum	Eurasian watermilfoil
Nymphaea tuberose	white water lily
Nuphar variegetum	yellow water lily
Potamogeton crispus	curlyleaf pondweed

Sampling Methodology for Summer Tier II Survey

Plant communities typically reach peak diversity between July 15 and August 31 so although only one sampling effort occurred it included a representative sample of the species within Bass Lake. Bass Lake required a total of one hundred sampling stations based on trophic status and acreage. According to the IDNR protocol, Bass Lake is classified as Mesotrophic which would require 10 sites from 15-20 feet. The maximum sampling depth for Bass Lake is 15 feet. The Tier II sampling was conducted at the eutrophic status so that sampling locations were apportioned to the required depth class. One hundred sites were sampled within the littoral zone (57 sites 0-5ft, 33 sites 5-10ft, and 10 sites 10-15ft) (Exhibit III).

At each station a sampling rake is used for collecting vegetation samples. Once a species is identified vegetation abundance is scored as a 1 (1-19%), 3 (20-99%), or 5 (+100%) based on density on the rake. Species are scored as a 9 if they are observed within the vicinity of the sampling station but not collected. After completion of all sampling stations a secchi disk depth reading and water quality measurements are taken.



V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: **Bass Lake Sampling Locations**		PROJECT: **Bass Lake Aquatic Plant Management Plan**	
BASE LAYER: Indiana Spatial Data 2006 Orthophotography		PROJECT NO. 07122	EXHIBIT: III	SHEET: 1 OF: 1
CLIENT: Bass Lake Conservancy District 3620 South CR 210 Knox, IN 46534		QUADRANGLE: Starke	DATE: 12/12/07	SCALE: 1"=20500'

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Results of Summer Tier II Survey

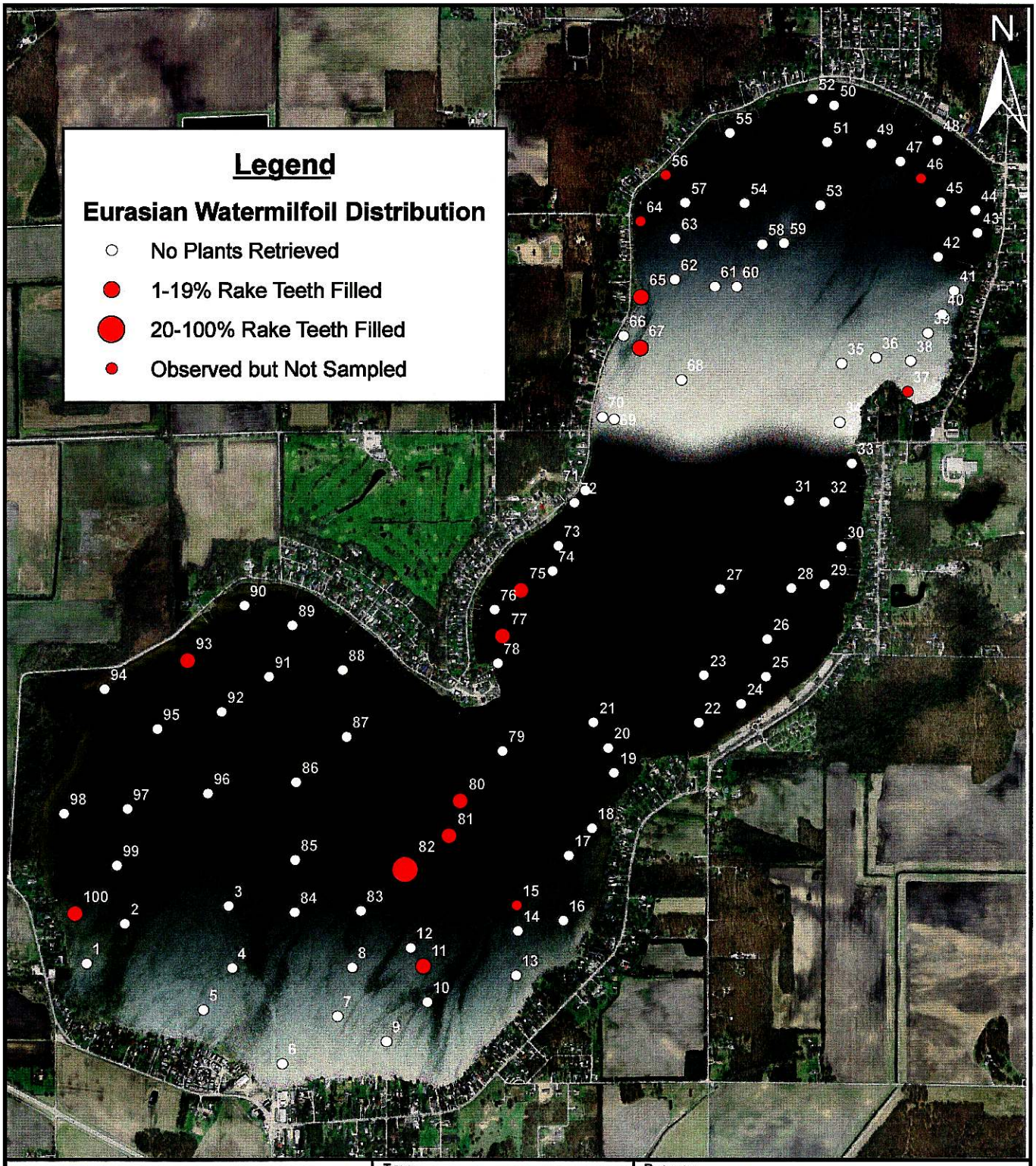
The Tier II survey completed on August 6, 2007 identified a total of 7 species within Bass Lake. Vegetation was present up to a maximum depth of 10 feet. A secchi disk depth measurement was taken after sampling and was found to be at 2.5 feet. Results of the sampling are listed in Table 2. The frequency of occurrence and dominance index of individual species at different depth ranges are located in the bottom half of Table 2.

Table 2: Occurrence and abundance of aquatic plants in Bass Lake on August 6, 2007.

County:	Starke	Sites with plants:	25
Date:	8/6/2007	Sites with native species:	14
Secchi (ft):	2.5	Number of species collected:	4
Maximum plant depth (ft):	10	Number of species observed:	3
Trophic status:	Mesotrophic	Number of native species:	5
Trophic status sampled:	Eutrophic	Maximum species/site:	4
		Total sites:	100

All depths (0 to 15 ft)		Frequency of	Rake score frequency per species				Plant
Common Name	Species	Occurrence	0	1	3	5	Dominance
Curlyleaf pondweed	Potamogeton crispus	5.0	95.0	5.0	0.0	0.0	1.0
Chara	Chara	13.0	87.0	10.0	2.0	1.0	4.2
Eurasian watermilfoil	Myriophyllum spicatum	9.0	86.0	8.0	1.0	0.0	2.2
Yellow water lily	Nuphar variegetum	2.0	98.0	0.0	2.0	0.0	1.2
Depth: 0 to 5 ft		**Frequency of**	**Rake score frequency per species**				**Plant**
Common Name	**Species**	**Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Curlyleaf pondweed	Potamogeton crispus	4.0	93.0	7.0	0.0	0.0	1.4
Chara	Chara	13.0	87.0	16.0	4.0	0.0	5.3
Eurasian watermilfoil	Myriophyllum spicatum	2.0	91.0	4.0	0.0	0.0	0.7
Yellow water lily	Nuphar variegetum	2.0	96.0	0.0	4.0	0.0	2.1
Depth: 5 to 10 ft		**Frequency of**	**Rake score frequency per species**				**Plant**
Common Name	**Species**	**Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
Curlyleaf pondweed	Potamogeton crispus	3.0	97.0	3.0	0.0	0.0	0.6
Chara	Chara	6.0	94.0	3.0	0.0	0.0	3.6
Eurasian watermilfoil	Myriophyllum spicatum	21.0	79.0	18.0	3.0	0.0	5.5
Depth: 10 to 15 ft		**Frequency of**	**Rake score frequency per species**				**Plant**
Common Name	**Species**	**Occurrence**	**0**	**1**	**3**	**5**	**Dominance**
**No species were found in this depth range.*							

Four species were collected during the Tier II survey. Chara was present at the highest percentage of sample sites (13%) followed by Eurasian watermilfoil (9%). Location and density of Eurasian watermilfoil is illustrated in Exhibit IV. Curlyleaf pondweed *(Potamogeton crispus)* and yellow water lily (*Nuphar variegetum*) were also collected but found at a small percentage of sites. Species observed within the vicinity of the sampling locations include white water lily, algae, and water willow. Datasheets from V3's sampling effort are located in Appendix I.



V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: Eurasian Watermilfoil Distribution and Abundance		PROJECT: Bass Lake Aquatic Plant Management Plan	
BASE LAYER: Indiana Spatial Data 2006 Orthophotography		PROJECT NO. 07122	EXHIBIT: IV	SHEET: 1 OF: 1
CLIENT: Bass Lake Conservancy District 3620 South CR 210 Knox, IN 46534		QUADRANGLE: Starke	DATE: 12/12/07	SCALE: 1"=20500'

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Aquatic Vegetation Sampling Discussion

The goals of the plan are to reduce invasive species occurrence while maintaining and enhancing the communities of native species. Water clarity continues to be a limiting factor of vegetation growth in Bass Lake and an attributing factor to low species diversity. Heavy boat traffic can stir up sediments contributing to the turbid water conditions within Bass Lake. The secchi disk depth measurement from our study was the same as last years survey by Aquatic Control. Secchi disk depth measurements at Bass Lake for the past four years are seen in Figure 1. The 2007 secchi disk depth measurement remained consistent with the average values over the past four years.

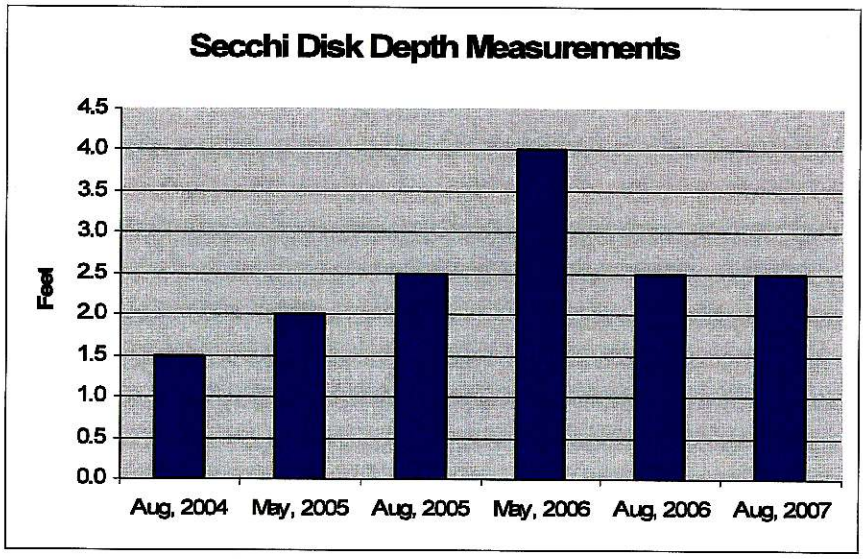


Figure 1: Bass Lake secchi disk depth measurements in the past four years.

Weed Patrol performed a whole lake fluridone treatment herbicide application in May also referred to as "sonar" treatment. This type of treatment does not target areas of Eurasian watermilfoil growth rather it establishes a fluridone concentration throughout the lake. Eurasian watermilfoil was present at 15% of sampling locations. It was recorded within the vicinity of a sampling site five times. According to IDNR Tier II aquatic vegetation survey protocol any dead or dying plant material that is intact and identifiable should be included in the study. Dead or decaying Eurasian watermilfoil accounted for 53% of the collections. Floating pieces of Eurasian watermilfoil were recorded within the vicinity due to this species ability to spread by fragmentation. Our study's results compared with Aquatic Controls indicate the treatment was effective in reducing densities of Eurasian watermilfoil (Figure 2).

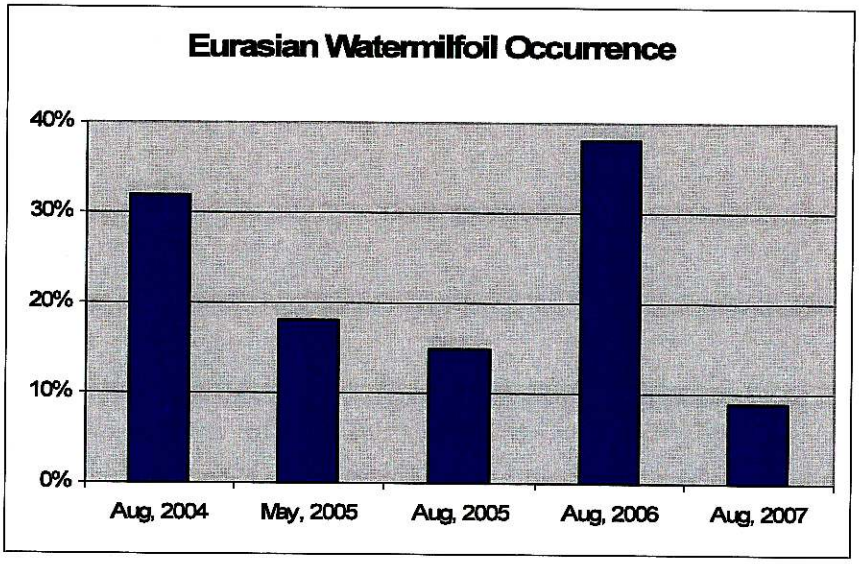


Figure 2: Bass Lake, Eurasian watermilfoil percent occurrence in the past five surveys.

Bass Lake has a low density and diversity of submersed aquatic vegetation. The 2007 Tier II survey result for percentage of sites with vegetation is the lowest of all five surveys. Seventy-five percent of sampling locations had no vegetation present (Figure 3). Lack of vegetation is likely due to the treatment application. Low species diversity of aquatic vegetation at Bass Lake continues to be a problem. Eurasian watermilfoil and curlyleaf pondweed, both invasive exotic species, accounted for half of the total species collected during the survey. Eurasian watermilfoil was found at depths ranging from two to fourteen feet. Curlyleaf pondweed was collected at depths ranging from three to six feet. The only native species collected were chara and yellow water lily (Figure 4). Chara was present from two to six feet of depth and yellow water lily was documented at three to four feet of depth. Factors that influence the establishment of native vegetation include high turbidity, competition with exotic species, and/or wave action caused by boat traffic. The native plant community may experience an increase due to successful reduction of Eurasian watermilfoil by the fluridone treatment.

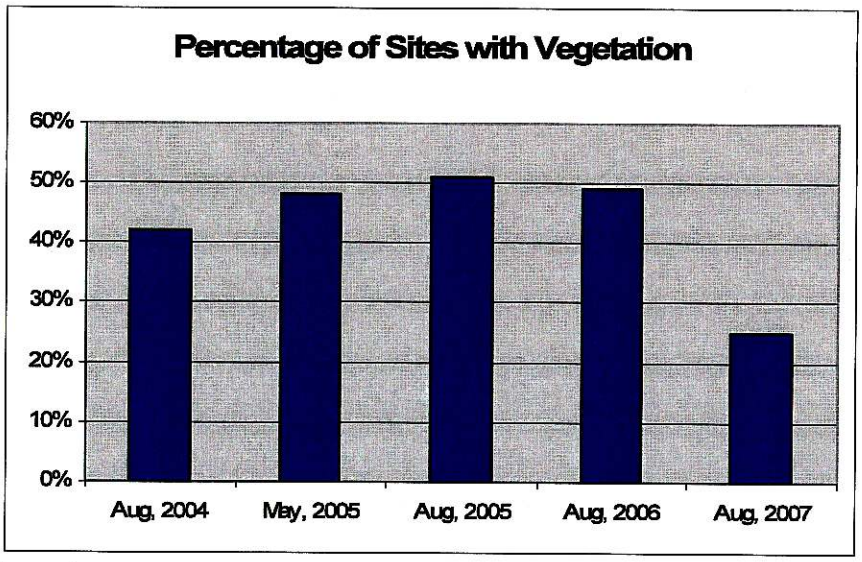


Figure 3: Bass Lake, comparison of percentage of sites with vegetation in the last five surveys.

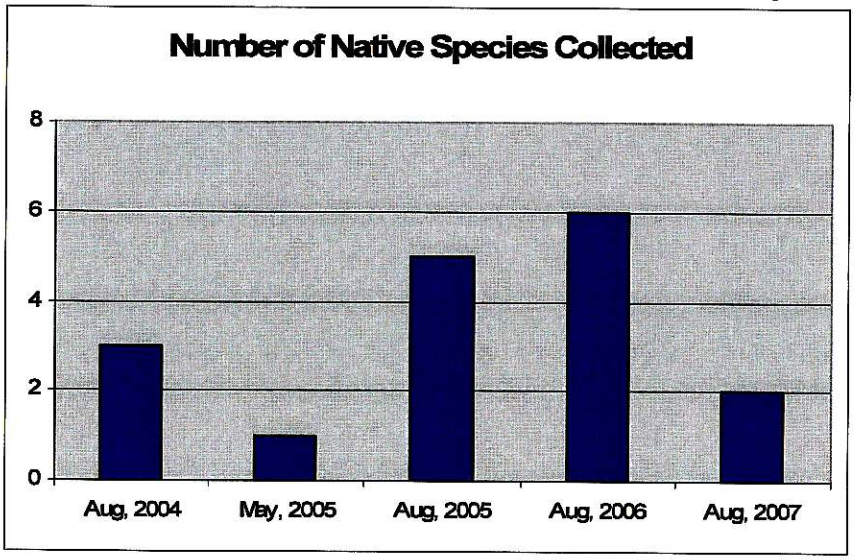


Figure 4: Bass Lake, comparison of number of native species collected in the past five surveys.

Aquatic Plant Management Alternatives

At the present time, the health of Bass Lake aquatic plant communities is poor. Native plant diversity is low. Continued management efforts to maintain the Eurasian watermilfoil population at a low level is desirable to prevent Eurasian watermilfoil from becoming the predominant species in the lake. Additionally, watershed activities to improve the water quality of Bass Lake are important to restore native plant diversity.

Many management strategies have been used to control Eurasian watermilfoil in Indiana lakes. A management strategy should be chosen based on its selectivity to the target species, it long-term effectiveness, and potential for detrimental side-effects (i.e., effects on non-target species). The foremost objective is to choose a management strategy that will effectively control the watermilfoil population with minimal negative effects on non-target plants or fish species.

Although dense beds of native aquatic plants can be a nuisance where they inhibit lake access, aquatic vegetation is important to maintaining a healthy lake ecosystem. Aquatic plants provide habitat for plankton, insects, crustaceans, fish, and amphibians. They take nutrients like phosphorus and nitrogen out of the water column, increase water clarity, prevent harmful algal blooms, produce oxygen and provide food for waterfowl. Aquatic plants can even remove pollutants from contaminated water and prevent the suspension of particulate matter by stabilizing sediment and preventing erosion from wave action or current.

Because of the overall importance of beneficial aquatic vegetation, one of the most basic goals of the LARE aquatic vegetation program is to maintain healthy aquatic ecosystems by maintaining or improving biodiversity in Indiana lakes, which includes protecting beneficial aquatic vegetation. As such, it is recognized that competing uses of the lakes including access for boating and maintaining plant beds to provide habitat for juvenile fish must be incorporated into an overall management strategy for the lake.

Different types of aquatic plant management alternatives are discussed below. One or more of these alternatives may be employed to meet the objectives of Bass Lake.

1 No Action

If no action is taken, the Eurasian watermilfoil abundance may remain stable, or it may increase from year to year. Eurasian watermilfoil spreads by fragmentation; when the plant is cut, the fragment has the ability to form an entirely new plant. Eurasian watermilfoil also over-winters as an adult plant and sprouts early in the spring. A major goal of this aquatic plant management plan is to prevent Eurasian watermilfoil from becoming a monoculture, and to maintain and enhance the current diversity of native aquatic plants. Therefore, it is imperative that Eurasian watermilfoil be controlled. Eurasian watermilfoil has a history of coming back after treatments, and diligent treatment of re-sprouts over several years is needed to provide long-term control. Taking no action might allow the Eurasian watermilfoil population to re-sprout after the 2007 and 2008 treatments and again expand to a problematic level.

2 Institutional Protection of Beneficial Vegetation

Lake users can play an important role in the protection of beneficial aquatic vegetation. Aquatic invasive species often gain a foothold in an ecosystem in areas disturbed by human activity or natural processes. In many cases, boating may be restricted in certain areas of a lake to prevent harm to native plants, especially many emergent species. Boating lanes may be established through important aquatic plant beds, and protected ecological zones may be created to prevent erosion of shoreline vegetation caused by intense wave action from boating activities. Shallow areas of a lake may also be marked with buoys to prevent injury to boaters. There currently are no boating restricted areas with the specific intent of protecting beneficial plant areas. However, the lakewide speed limit effectively minimizes wave action due to wakes, and protects beneficial vegetation, such as the emergent wetland shoreline in the northeastern portion of the lake.

3 Environmental Manipulation

Draw down of the lake water level is one option that may decrease the Eurasian watermilfoil population. Lower water levels expose the Eurasian watermilfoil roots to freezing and thawing, which may kill milfoil root systems. However, a lake drawdown will not only kill Eurasian watermilfoil but all native plants as well. Also, reducing the lake level may make new areas of the lake available for vegetative growth, and Eurasian watermilfoil may have an advantage in the colonization of these new areas.

4 Nutrient Reduction

An overabundance of nutrients can greatly increase the possibility that an invasive species will proliferate in a body of water. Limiting factors for plant growth include light, lake morphometry and depth, substrate, and the availability of nutrients like phosphorus and nitrogen. While lake morphometry is most highly correlated with plant biomass, the availability of phosphorus and nitrogen have a significant impact on the amount of plant growth in a body of water. If the vast majority of phosphorus in a system is tied up in plant matter, it may be difficult for an invasive species to become established and spread rapidly in a lake. If phosphorus is constantly being added to the system and is readily available in the water, invasive species can use the nutrient excess and take over an aquatic system within a few growing seasons. Additionally, herbicide applications to native plant beds can cause a single large release of nutrients as the killed vegetation decomposes, coupled with available space for the germination of new species. This combination of conditions presents a ripe opportunity for the establishment of an invasive species such as Eurasian watermilfoil.

Phosphorus and nitrogen are added to aquatic systems by many natural sources, such as the decomposition of plant material and animal waste. Human activity, however, is often responsible for excessive phosphorus loading that contributes to blue-green algal blooms, overabundant vegetation growth, and a general decline in water quality. Major contributions of excess phosphorus come from sources such as septic system inputs, agricultural runoff, storm water drainage, lawn fertilizer applications, and improper disposal of grass clippings and tree leaves. Owners of lake front property can reduce the amount of phosphorus entering the lake by taking actions. In addition, implementation of best management practices throughout the watershed, such as filter strips, no till agriculture, wetland preservation or restoration, and streambank stabilization, would reduce the sediment and nutrient inputs into the lake, improve water quality, and lessen conditions that favor invasive species.

5 Mechanical Cutting and Harvesting

Mechanical harvesting involves using a large machine to cut and collect unwanted aquatic plants. The machine picks up the cut weeds but leaves small fragments behind. Since Eurasian watermilfoil is able to reproduce from cut fragments, mechanical harvesting can spread this invasive species. Additionally, mechanical harvesting is not selective and will cut both native and exotic plant species. Where both are growing together, mechanical harvesting will give an advantage to Eurasian watermilfoil over any native species that are present, given its growth and reproductive characteristics. Each fragment clipping of Eurasian watermilfoil is capable of becoming reestablished as a complete plant. For these reasons, mechanical harvesting is not recommended in any area inhabited by Eurasian watermilfoil. Harvesting can be accomplished by individual owners around their dock areas. A lake property owner can legally harvest a 625 square foot area (25 feet by 25 feet).

6 Hand-Pulling, Cutting, Raking

Manual controls such as hand pulling, cutting, and raking can be effective ways to control unwanted plants in certain situations. In very shallow clear water, small areas of vegetation can be identified and cleared by hand. Large areas of vegetation, especially those in deeper water, can be extremely difficult to control using these methods. Many of the harvested weeds will break apart, leaving the root system in the lake bottom. Failure to remove root structures will result in re-growth.

Plants such as Eurasian watermilfoil that possess the ability to reproduce through fragmentation can seldom be effectively controlled by these methods if they are distributed throughout a lake. Identifying every area of infestation would be difficult, as would harvesting the plants without causing fragmentation of plant parts. Any plant fragments not removed from the water can form new plants, meaning that hand pulling and cutting can facilitate the spread of unwanted plant species such as Eurasian watermilfoil. The infestation of Eurasian watermilfoil has been too large in recent years, and shown too high a potential for expansion for hand-pulling, cutting, or raking to be viable options.

7 Bottom Barriers

Bottom barriers prevent the growth of aquatic plants by lining the bottom of a lake or pond with a material that prohibits light from reaching the lake bottom, which is difficult for plants to penetrate. Often plastic or concrete barriers are installed during construction of a lake or pond to prevent subsequent growth of aquatic vegetation. This form of control is best implemented during construction of a new pond or lake. Placing a bottom barrier in an existing lake would involve significant logistical challenges and would be extremely expensive. A draw down of the lake may be necessary to install the barrier. Once in place, the barrier would prevent plant growth of both invasive and native species, and would deprive the lake ecosystem of the benefits provided by native aquatic plants. Sediment would gradually accumulate on top of the barrier, and aquatic plant growth would return as plants begin to take root in the sediment on top of the barrier; bottom barriers generally do not provide effective long-term control. Bottom barriers may not be placed without a permit for shoreline construction from the IDNR Division of Water.

8 Biological Controls – Water Milfoil Weevil

The water milfoil weevil is a native North American insect that consumes Eurasian watermilfoil and northern milfoil. The milfoil weevil burrows into the stem and consumes tissue of the plant. Holes in the milfoil stem bored by weevil larvae allow disease an entrance pathway. These same holes also cause a release of the plant's gases, which reduces buoyancy and causes the plant to sink. All biological controls, including water milfoil weevil stocking, may not be implemented without an aquatic plant control permit from the IDNR Division of Fish & Wildlife.

Studies conducted to evaluate the effectiveness of the water milfoil weevil have not yielded consistent results. Factors influencing the weevil's success or failure in a body of water are not well documented. In 2003, Scribailo and Alix conducted a weevil test on Round Lake in Indiana and found no conclusive evidence that the Eurasian watermilfoil populations were reduced. In addition to this potential ineffectiveness, a large population of Eurasian watermilfoil must be present to support the weevil population. For both of these reasons, using the water milfoil weevil as a biological control agent for Eurasian watermilfoil is not recommended at Bass Lake.

9 Biological Controls – Grass Carp

The Asian grass carp (*Ctenopharyngodon idella*) is an herbivorous fish that is native to eastern Russia and China. This fish has been introduced into the U.S. to help control aquatic vegetation. To prevent their uncontrolled proliferation, all fish stocked in Indiana must be triploid, meaning that they are sterile and cannot reproduce. Stocking is restricted to privately owned bodies of water, and suppliers must obtain a special permit from the IDNR. All biological controls, including grass carp stocking, may not be implemented without an aquatic plant control permit from the IDNR Division of Fish & Wildlife.

Grass carp are completely vegetarian, feeding on many species of submersed plants, in addition to some floating plants such as duckweed. Hydrilla, a highly invasive plant found in many southern states, is a preferred food of grass carp, and efforts to control hydrilla with grass carp have been successful. However, grass carp avoid Eurasian watermilfoil and show strong preferences for many native plants in addition to hydrilla. Therefore, when Eurasian watermilfoil occurs with native plant populations, grass carp are not recommended.

10 Chemical Controls – Aquatic Herbicides

There are two major categories of aquatic herbicides: contact and systemic herbicides. Contact herbicides are not selective, and thus are best used to control plants around piers and in navigation channels. Given the lack of selectivity and their inability to eliminate the root systems of treated plants, contact herbicides have the potential to cause unnecessary damage to native species. Additionally, there is potential for re-infestation of Eurasian watermilfoil. Reward (active ingredient: diquat) and Aquathal (active ingredient: endothal) are two examples of contact herbicides.

Although contact herbicides generally are not selective, timing and dosage can be adjusted to make them affect the target species with less damage to non-target species. The phenological timing method of contact herbicide treatment for Eurasian watermilfoil has shown some success. Recent tests have shown that by adjusting the dosage higher and timing the treatment exactly, a systemic effect on Eurasian watermilfoil can be achieved with contact herbicides. This method involves treating the plants very early in the spring when carbohydrate reserves of Eurasian watermilfoil have left the root structure, promoting rapid growth in the other plant structures. Since Eurasian watermilfoil is growing more actively earlier in the spring than other species, the risk to non-target plants is relatively low if timed properly.

The contact herbicide commonly used for selective low-dose control of Eurasian watermilfoil in mid-season is Reward. A low-dose contact herbicide application can be relatively selective, since Eurasian watermilfoil is susceptible to some herbicides at a dose lower than most native plants due to their high growth rate. As a complicating factor, low-dose applications to control Eurasian watermilfoil with Reward are difficult in lakes where high levels of single-cell algae are present. Reward's mode of action is that it binds with positively charged particles in the water column. Since turbid conditions within Bass Lake indicate presence of single-cell algae (positively charged), Reward will bind with algae in the water column and not affect the milfoil.

Although Reward is not marketed as an algaecide, alga is shown on the label as controlled by this product. Since alga is moderately abundant during mid-summer at Bass Lake, the effectiveness of a low-dose contact treatment may be compromised.

Systemic herbicides are absorbed by the plant and transported to the root systems where they kill both the roots and the plant. Examples of systemic herbicides are Sonar and Avast (active ingredient: fluridone); Navigate, Aqua Kleen, DMA4 (active ingredient: 2,4-D), and Renovate (active ingredient: triclopyr). All of these products effectively kill Eurasian watermilfoil plants and roots. Whole lake treatments of fluridone are often used in lakes that have become severely infested with Eurasian watermilfoil. Fluridone can be applied at low rates to control the Eurasian watermilfoil while causing minimal damage to most of the native plant species present. Curly-leaf pondweed is also susceptible to fluridone at the low dose used on Eurasian watermilfoil.

Triclopyr and 2,4-D are both systemic herbicides that are often used for spot treatments in small areas of Eurasian watermilfoil. These herbicides kill all dicots (broadleaf plants such as coontail, waterweed, watermilfoils, etc.) but do not affect monocots (such as eel grass or pondweeds). In preliminary studies, triclopyr may have the ability to control Eurasian watermilfoil in select areas longer than 2,4-D, but this potential benefit is outweighed by higher cost. Neither chemical affects curly-leaf pondweed.

The public's primary concern with the use of aquatic herbicides is safety. Each chemical registered for aquatic applications has undergone extensive testing prior to becoming available for use. It is imperative that any aquatic herbicide be applied by a licensed professional in accordance with its label to minimize potential side-effects.

2007 Vegetation Control

Aquatic Control applied Renovate herbicide to 58 acres of milfoil on June 1, 2006. Control of the milfoil was achieved in treated areas. Further treatments were required outside of treatment areas where Eurasian watermilfoil had reached nuisance levels. The additional treatments were funded through the Bass Lake Conservancy District and applied August 23 with Renovate.

Weed Patrol performed a whole lake fluridone treatment herbicide application on May 14, 2007 with a concentration of 7 parts per billion (Exhibit II). A second treatment of 3 ppb, or bump, was applied on June 15, 2007 in order to maintain the fluridone concentration within the lake. The Tier II sampling effort on August 6, 2007 indicated success of treatment. No areas of Eurasian watermilfoil beds were identified and much of the plant material collected was dead or decaying.

There are no known state or federally protected threatened or endangered species present within Bass Lake. No voucher specimens were collected during the efforts of this project. There are no anticipated adverse impacts to any state or federally protected threatened or endangered species as it relates to the use of the vegetation control herbicides recommended within this plan.

Public Involvement

A public meeting was held November 15, 2007 at the Bass Lake Community Center in Knox, Indiana. Nine individuals attended the meeting. V3 discussed current plant management activities, results of the Tier II survey, and future management. A lake use survey was handed out after the meeting ended and seven individuals participated. Summary totals from the completed lake use survey are shown in Figure 5. Eighty-five percent had property adjacent to the lake. Seventy-one percent of lake property owners had been at the lake for 10 years or more. The remaining twenty-nine percent had been at the lake for 5 to 10 years. Questions concerning lake use found that 100% of those surveyed used the lake for swimming and boating, 42% for fishing, and 14% indicated other as their uses. When interpreting results from surveys many participants indicate aesthetic qualities of the lake such as sunsets or nature. This option could be used in future surveys to account for these individuals. Nobody surveyed used the lake for irrigation or drinking water. Questions concerning problems with the lake found that 71% believed too many boats access the lake, 57% thought too many jet skis, 42% thought there was overuse by nonresidents and too many aquatic plants, and 28% felt that dredging was needed and pier funneling was a problem. Nobody surveyed thought there was too much fishing, fish population problems, poor water quality, or not enough plants. All of those surveyed were in favor of continuing efforts to control vegetation on the lake and 28% thought the level of aquatic vegetation affected their property value. Overall the group expressed satisfaction by the reduction of Eurasian watermilfoil through Weed Patrol's sonar herbicide treatment. Concern was also expressed in the lack of vegetation in Bass Lake. Original lake use survey sheets are located in Appendix I.

Aquatic Plant Management Plan
Lake Use Survey for Bass Lake

Are you a lake property owner? Yes 6 No 1

Are you currently a member of your lake association? Yes 6 No 1

How many years have you been at the lake?

2 or less	0
2-5 years	0
5-10 years	2
Over 10 years	5

How do you use the lake (mark all that apply)

7 Swimming	0 Irrigation
7 Boating	0 Drinking water
3 Fishing	1 Other _____

Do you have aquatic plants at your shoreline in nuisance quantities?	Yes 4	No 3
Do you currently participate in a weed control project on the lake?	Yes 6	No 1
Does aquatic vegetation interfere with your use or enjoyment of the lake?	Yes 6	No 1
Does the level of vegetation in the lake affect your property values?	Yes 2	No 5
Are you in favor of continuing efforts to control vegetation on the lake?	Yes 7	No 0
Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded?	Yes 6	No 1

Mark any of these you think are problems on your lake:

5 Too many boats access the lake
4 Use of jet skis on the lake
0 Too much fishing
0 Fish population problem
2 Dredging needed
3 Overuse by nonresidents
3 Too many aquatic plants
0 Not enough aquatic plants
0 Poor water quality
2 Pier/funneling problem

Please add any comments:

_____

_____

Figure 5: Summary totals from completed Lake Use Survey Forms.

Hydrilla (*Hydrilla verticillata*) was also discussed at the public meeting since it was discovered in Lake Manitou, which is 22 miles from Bass Lake. Lake Manitou, in Rochester Indiana, is the only lake in the Midwest where hydrilla is known to exist. Hydrilla is an invasive aquatic species that was originally imported into Florida as an aquarium plant in the 1950's. The main adaptations that give hydrilla an advantage over other native plants are: it can grow at low light intensities, it is better at absorbing carbon dioxide from water, it is able to store nutrients for later use, and it can tolerate a wide range of water quality conditions. Hydrilla can be easily confused with native elodea. The best characteristic to distinguish hydrilla is that it generally has five leaves at each node and leaves have visible teeth (Figure 6). Once established, hydrilla can easily spread by fragmentation. It is important for all lake users to remove all plant material and sediment from their boats and trailers when entering or leaving Bass Lake. Hydrilla causes substantial economic hardships, interferes with water uses, and displaces native aquatic plant communities. If hydrilla is identified in Bass Lake immediately contact the Indiana Department of Natural Resources, Division of Fish and Wildlife. More information about controlling the spread of Hydrilla can be found at www.protectyourwaters.net.

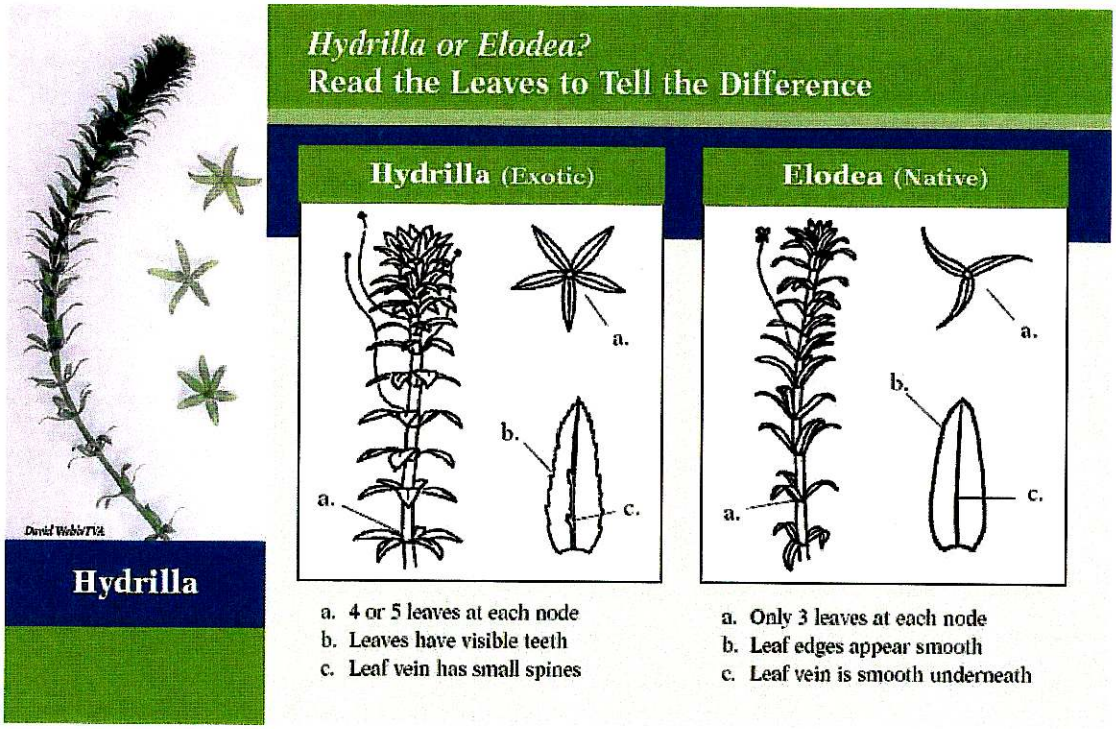
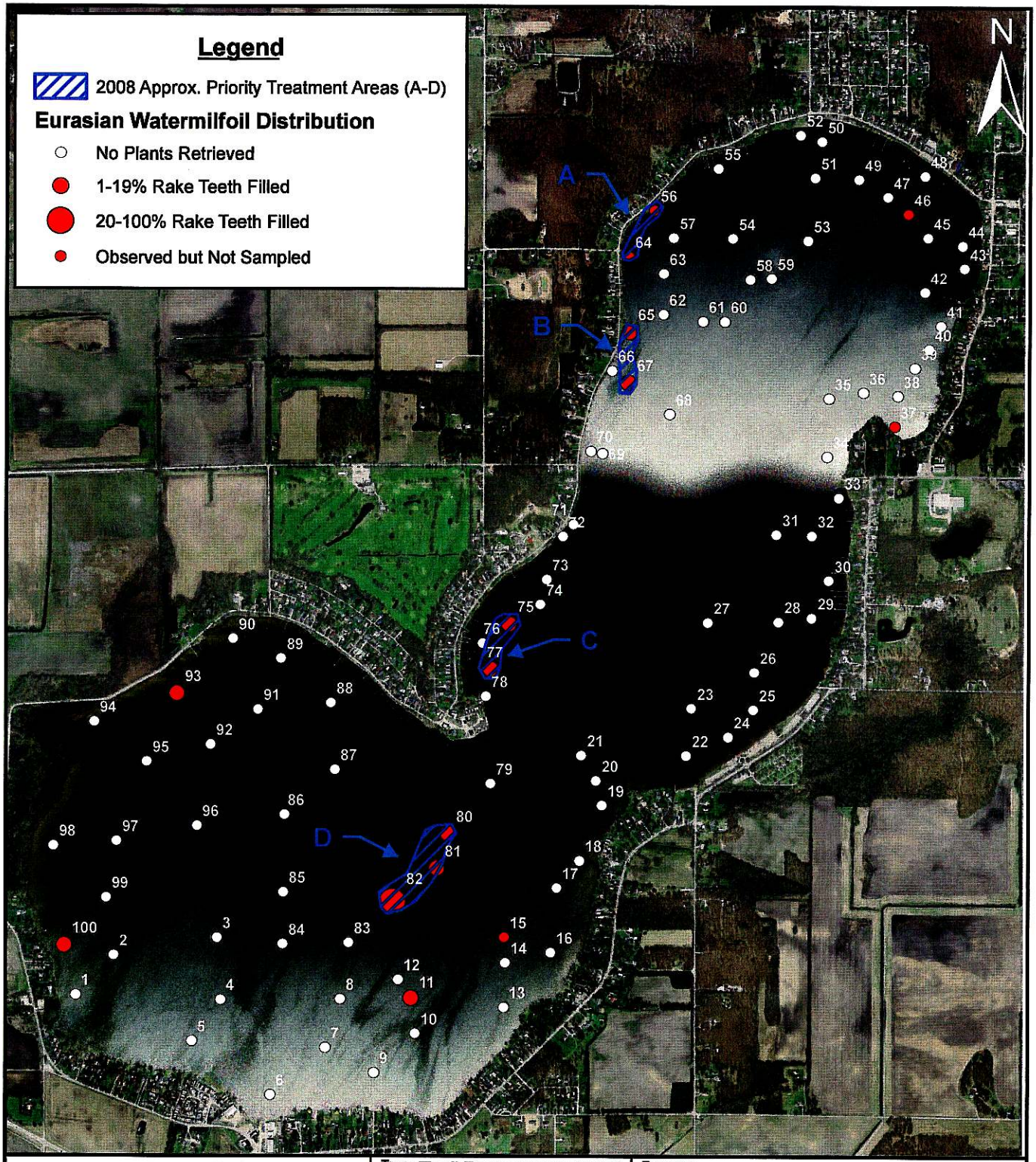


Figure 6: Illustration of Hydrilla compared to native elodea. (Illustrations provided by Michigan Sea Grant)

Action Plan

V3 identified four approximate priority treatment areas for 2008 based on the results of the post treatment aquatic vegetation survey (Exhibit V). A total of twenty acres are requested for Renovate or 2,4-D treatment in 2008. Priority treatment areas location and acreage are described within the Application for Aquatic Vegetation Control Permit located in Appendix II. Plant sampling will be very important for the long-term success of the fluridone treatment. Areas surrounding the public access should be thoroughly inspected due to its potential as a point for introduction. If re-establishment of native vegetation it not seen in subsequent surveys it is recommended that recommended that planting options be seriously evaluated for implementation.

As the action plan is implemented, aquatic plant surveys will help to monitor the effectiveness of the management strategy. The abundance distribution of Eurasian watermilfoil will be recorded using the current IDNR Tier II sampling protocol. After the Spring 2008 Target Species Distribution Map is created, the distribution and abundance of Eurasian watermilfoil will be identified and treatment maps will be prepared. The survey will also document whether native plants have re-colonized areas of previous Eurasian watermilfoil infestation. The new data analysis results will be incorporated into the current lake management plan. This will provide property owners, applicators, and the IDNR with detailed records describing the changes within the plant communities of Bass Lake. In years to follow, additional surveys will be conducted to determine how the Eurasian watermilfoil population and the native aquatic plant beds are reacting to any treatment. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public should the management strategy need to be modified. They will also serve to keep the public informed about management practices at the lake so they will be motivated and educated to actively participate in conservation of the Bass Lake ecosystem.



V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

TITLE: **Tier II Eurasian Watermilfoil Results with Priority Treatment Areas for 2008**		PROJECT: **Bass Lake Aquatic Plant Management Plan**	
BASE LAYER: Indiana Spatial Data 2006 Orthophotography	PROJECT NO. 07122	EXHIBIT: V	SHEET: 1 OF: 1
CLIENT: Bass Lake Conservancy District 3620 South CR 210 Knox, IN 46534	QUADRANGLE: Starke	DATE: 12/12/07	SCALE: 1"=20500'

E:\2007\07122\Reports\Natural Resources\Wetland\Exhibits\07122 Eurasian Priority Treatment 2008.mxd

Implementation of Action Plan

1. Spring 2008 Target Species Distribution Map, and Proposed Treatment Area Map. The site visit and investigation necessary to create these two maps will allow for the determination of the extent of follow-up chemical treatment that will be necessary to treat Eurasian watermilfoil. As of July, the 2007 chemical treatment effectively reduced the Eurasian watermilfoil population. The Spring 2008 mapping will determine the extent and location of milfoil re-growth.

2. Follow-up Herbicide Treatment to Eurasian watermilfoil. An early spring (3rd week of April to mid-May) systemic herbicide application of 2,4-D is proposed during 2008 to treat the Eurasian watermilfoil that has re-grown since the 2007 herbicide application.

3. Summer 2008 Tier II Aquatic Plant Survey. A Tier II aquatic plant survey should be conducted during the Summer 2008 to document the diversity, distribution and abundance of aquatic plants. This data is important to ensure that the native plant community is protected, and that the Eurasian watermilfoil population is kept under control.

The management goal for 2008 is to keep the Eurasian watermilfoil populations below nuisance quantities. The overall goal for Bass Lake is the results of the 2008 sampling are equal to or less than the 2007 Eurasian watermilfoil density and abundance which would demonstrate effective herbicide treatments and management.

Budget Update

The following costs are estimated based on lake size, average depth, chemical and application costs, as well as LARE survey requirements. In an attempt to assist LARE staff with alternatives in the event of grant funding limitations, the implementation of the 2007 Herbicide Application and Tier II survey is of a higher priority than the 2008 Tier II survey. The proposed management schedule and budgets for 2008 and 2009 are summarized below.

2008

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Early Spring Systemic Herbicide Application of 2,4-D or Renovate (assumed 20 acres)	$8,000
Late season post treatment aquatic plant survey (Tier II) and plan update	$5,000

2009

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Late season (post treatment) aquatic plant survey (Tier II) and plan update	$5,000

Any herbicide applications will depend on the results of the surveys. Sources for future funding of Aquatic Plant Management Plans are located in Appendix III.

These management activities and plant surveys are proposed to improve Bass Lake's ecosystem and facilitate the achievement of overall goals established by the IDNR. These overall goals established by the IDNR for all lakes applying for LARE funding are: 1) develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species; 2) direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species; and 3) provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

Monitoring and Plan Updates

As the action plan is implemented, aquatic plant surveys will help to monitor the effectiveness of the management strategy. The abundance distribution of Eurasian watermilfoil will be recorded using the current IDNR Tier II sampling protocol.

The results of the 2007 post-treatment sampling reflect progress toward the goals stated in the 5 year plan. The following surveys will demonstrate whether or not the absence of Eurasian watermilfoil will allow for native species to re-establish within Bass Lake. Water quality may be a larger focus in future management. There were no species found past 10 foot depth zone and should monitored within the following years to ensure Eurasian watermilfoil doesn't establish.

After the Spring 2008 Target Species Distribution Map is created, the distribution and abundance of Eurasian watermilfoil will be identified and treatment maps will be prepared. The survey will also document whether native plants have re-colonized areas of previous Eurasian watermilfoil infestation. The new data analysis results will be incorporated into the current lake management plan. This will provide property owners, applicators, and the IDNR with detailed records describing the changed in the plant community of Bass Lake.

In years to follow, additional surveys will be conducted to determine how the Eurasian watermilfoil population and the native aquatic plant beds are reacting to any treatment regimes. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public should the management strategy need to be modified. They will also serve to keep the public informed about management practices at the lake so they will be motivated and educated to actively participate in conservation of the Bass Lake ecosystem.

References

J.F. New & Associates. 2002. Bass Lake Diagnostic Study. Walkerton, IN

Langeland, K.A. 1996. *Hydrilla verticillata* (L.F.) Royle (Hydrocharitaceae), "The Perfect Aquatic Weed". Castanea 61:293-304. 1 July 2004.

Yousef, Y.A., W.M. McLellon, R.H. Fagan, H.H. Zebuth, and C.R. Larrabee. 1978. Mixing effects due to boating activities in shallow lakes. Draft Rep. To OWRT, U.S. Dep. Inter. Tech. Rep. ESEI No. 78-10, Washington, D.C. 199 pp.

Appendices

Appendix I- Data Sheets, Tier II Latitude/Longitude, and Survey Questionnaires
Appendix II- Vegetation Control Permit
Appendix III- Resources for Aquatic Vegetation Management

APPENDIX I

DATA SHEETS, TIER II LATITUDE/LONGITUDE AND SURVEY QUESTIONNAIRES

Aquatic Vegetation Random Sampling (Tier 2)

Waterbody Cover Sheet

Surveying Organization: V3 Companies

Contact Information: Ed Belmonte, EBelmonte@V3co.com

Waterbody Name: Bass Lake

Lake ID:

County(s): Starke

Date: 08062007

Habitat Stratum: 1L

Avg. Lake Depth (ft):

Lake Level:

Crew Leader: Walter Levernier

GPS Metadata

Datum:

Zone: 16

Accuracy:

Recorder: Jessica Dunn

Method:

Secchi Depth (ft): 2.5

Total # of Points Surveyed: 100

Total # of Species: 7

Littoral Zone Size (acres):

- ☐ Measured
- ☐ Estimated

Littoral Zone Max. Depth (ft):

- ☐ Measured
- ☐ Estimate (historical Secchi)
- ☐ Estimated (current Secchi)

Notable Conditions:

D.O - 9.07
Temp - 27.3°C.
*no flower heads present in NUPVAR

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: Bass Lake
DATE: August 10, 2007
COUNTY: Starke
SECCHI DEPTH (FT): 2.5 ft
SITE ID:
MAX PLANT DEPTH (FT): 6 ft
SURVEYING ORGANIZATION: VS Companies
WEATHER: Partly Cloudy
CREW LEADER: Walter Levernier
COMMENTS (Include voucher codes - V1, V2,...):
RECORDER: Jessica Dunn
CONTACT INFO: Ed Belmonte

Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.

GPS #	Point #	R/T	Latitude	Longitude	Depth	Species Codes: POTCRI	CHARA	MYRSPI	ALGA					Notes
218	1	R			2									no veg
219	2	R			3	1	1							
220	3	R			6		1							
221	4	R			5		3							
442	5	R			4									no veg
443	6	R			3	1	1							
444	7	R			4	1	1							
445	8	R			9									no veg
446	9	R			2									no veg
447	10	R			4		1							Small amount of CHARA
448	11	R			8			1						Small amount
449	12	R			15									no veg
450	13	R			2		1		9					
451	14	R			7									no veg
452	15	R			14			9						no veg - MYRSPI on surface of water
463	16	R			3									no veg
454	17	R			6									no veg
455	18	R			2									no veg
456	19	R			2									no veg
457	20	R			6									no veg
458	21	R			13									no veg
459	22	R			6									no veg, decaying plant
460	23	R			11									no veg
461	24	R			4									no veg
462	25	R			3									no veg
463	26	R			3									no veg
464	27	R			6									no veg
465	28	R			8									no veg - decaying plant material
466	29	R			2									no veg
467	30	R			2									no veg
468	31	R			7									no veg
469	32	R			4									no veg
470	33	R			2									no veg

Other plant species observed at lake:

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: Bass Lake
COUNTY: Starke
SITE ID:
SURVEYING ORGANIZATION: V3 Companies
CREW LEADER: Walter Levernier
RECORDER: Jessica Dyer
CONTACT INFO: Ed. Belmonte

DATE: August 6, 2015
SECCHI DEPTH (FT): 2.5 ft
MAX PLANT DEPTH (FT): 6 ft
WEATHER: Mostly Sunny
COMMENTS (Include voucher codes - V1, V2...):

Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.

GPS #	Point #	R/T	Latitude	Longitude	Depth	Species Codes: POTPUL	CHARA	MYRSPI	ALGA	NUPVAR	NYMTUB	JUSAME		Notes
471	34	R			6									no veg
472	35	R			11									no veg dead stem
473	36	R			7									no veg
474	37	R			4			9		3				
475	38	R			13									no veg
476	39	R			8									no veg
477	40	R			4									no veg
478	41	R			3									no veg - rocky botto
479	42	R			9									no veg
480	43	R			3									no veg
481	44	R			9									no veg
482	45	R			10									no veg
483	46	R			14			9						no veg
484	47	R			6									no veg
485	48	R			2									no veg
486	49	R			5									no veg
487	50	R			2									no veg dead stem
488	51	R			4									no veg
489	52	R			2									no veg (plant materie decaying
490	53	R			6									no veg
492	54	R			4									no veg
493	55	R			2									no veg
494	56	R			2			9						no veg
495	57	R			3									no veg - herbicide ste and treating MYRSP
496	58	R			6									no veg
497	59	R			14									no veg
498	60	R			6									no veg
499	61	R			5									no veg
500	62	R			6									no veg
501	63	R			4									no veg
502	64	R			3			9		3	9	9		no veg
503	65	R			5			1						NUPVAR no flower head dead stems
504	66	R			3									no veg

Other plant species observed at lake:
purple loosestrife near Pt#52

GPS # 491 → Secchi disk reading

DO - 9.07
Temp - 27.3°C

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: Rack Lake	DATE: August 6, 2007
COUNTY: Starke	SECCHI DEPTH (FT): 2.5 ft
SITE ID:	MAX PLANT DEPTH (FT): 6ft
SURVEYING ORGANIZATION: V3 Companies	WEATHER: Mostly Sunny
CREW LEADER: Walter Levernier	COMMENTS (Include voucher codes - V1, V2,...):
RECORDER: Jessica Dunn	
CONTACT INFO: Ed Belmonte	

Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.

GPS #	Point #	R/T	Latitude	Longitude	Depth	Species Codes: POTCRI	CHHISP1	MYRSP1	ALGA	NUTVAR	MYMIUE	UTSAME	Notes
505	107	R			9			1					no veg dead stems
506	108	R			12								no veg
507	109	R			7								no veg
508	70	R			5								no veg
509	71	R			8								no veg
510	72	R			2								no veg
511	73	R			7								no veg
512	74	R			12								no veg dead stems
513	75	R			10			1					dead milfoil stem
514	76	R			4								no veg abundant
515	77	R			8			1					dead milfoil stem abundant
516	78	R			2								No veg
517	79	R			3								no veg
518	80	R			8			1					dead milfoil stem abundant
519	81	R			10			1					dead milfoil abundant
520	82	R			9			3					dead milfoil stem
522	83	R			7								no veg
523	84	R			6								no veg
524	85	R			4								no veg
525	86	R			3								no veg
526	87	R			4								no veg
527	88	R			5	1							no veg dead milfoil
528	89	R			4		1						dead milfoil
529	90	R			7		1						dead milfoil
530	91	R			4								no veg
531	92	R			4								no veg
532	93	R			3		3	1					no veg dead milfoil
533	94	R			3		1						dead milfoil
534	95	R			4								dead chara
535	96	R			6	1	5						
536	97	R			4								no veg
537	98	R			2		1						
538	99	R			3								no veg
539	100	R			3	1		1					some dead MYRSP1 & POTCRI

Other plant species observed at lake:

discard 521

Bass Lake Aquatic Plant Management Plan Update-2007, Tier II Sampling, July 2007

Tier II Sampling Location Number	Latitude	Longitude
1	41.21241	-86.61026
2	41.21375	-86.60855
3	41.21433	-86.6039
4	41.21224	-86.60375
5	41.21085	-86.60505
6	41.20902	-86.60153
7	41.2106	-86.59906
8	41.21224	-86.59839
9	41.20975	-86.59691
10	41.21107	-86.59506
11	41.21227	-86.59524
12	41.21289	-86.59581
13	41.21194	-86.5911
14	41.21344	-86.59101
15	41.21431	-86.59105
16	41.21378	-86.58897
17	41.21597	-86.5887
18	41.21688	-86.58766
19	41.21875	-86.58666
20	41.21958	-86.58692
21	41.22044	-86.58757
22	41.22042	-86.58289
23	41.22202	-86.58264
24	41.22104	-86.581
25	41.22196	-86.57988
26	41.22322	-86.57983
27	41.22491	-86.5819
28	41.22493	-86.57875
29	41.22505	-86.57727
30	41.22632	-86.5765
31	41.22787	-86.57883
32	41.22783	-86.57726
33	41.22911	-86.57604
34	41.2305	-86.57657
35	41.23247	-86.57648
36	41.23266	-86.57494
37	41.23152	-86.57354
38	41.23254	-86.5734
39	41.23349	-86.57263
40	41.23412	-86.57199
41	41.23491	-86.57145
42	41.23605	-86.57217
43	41.23685	-86.5704
44	41.23761	-86.57048
45	41.23789	-86.57203
46	41.23869	-86.5729
47	41.23926	-86.57382
48	41.23997	-86.57216
49	41.23986	-86.57511
50	41.24114	-86.57677

Tier II Sampling Location Number	Latitude	Longitude
51	41.23991	-86.57708
52	41.24136	-86.57772
53	41.23779	-86.5774
54	41.23787	-86.58075
55	41.24024	-86.58139
56	41.23883	-86.58425
57	41.2379	-86.58341
58	41.23649	-86.57998
59	41.23652	-86.57902
60	41.23507	-86.58112
61	41.23508	-86.58209
62	41.23532	-86.58387
63	41.2367	-86.58385
64	41.23728	-86.58539
65	41.23474	-86.58538
66	41.23343	-86.58616
67	41.23302	-86.58543
68	41.23195	-86.5836
69	41.23063	-86.5866
70	41.23071	-86.58713
71	41.22824	-86.5879
72	41.22783	-86.58838
73	41.22638	-86.58912
74	41.22554	-86.58939
75	41.22489	-86.5908
76	41.22424	-86.59199
77	41.22336	-86.59163
78	41.22244	-86.59185
79	41.2195	-86.59165
80	41.21781	-86.59355
81	41.21664	-86.59406
82	41.21553	-86.59604
83	41.21414	-86.598
84	41.21411	-86.60094
85	41.21586	-86.60091
86	41.21848	-86.60085
87	41.21999	-86.59859
88	41.22224	-86.59876
89	41.22375	-86.60098
90	41.22442	-86.60313
91	41.22203	-86.60203
92	41.22085	-86.60416
93	41.22258	-86.60567
94	41.22163	-86.60939
95	41.22029	-86.60703
96	41.21812	-86.60479
97	41.2176	-86.6084
98	41.21745	-86.61123
99	41.2157	-86.60888
100	41.21409	-86.61077

Aquatic Plant Management Plan
Lake Use Survey for Bass Lake

Are you a lake property owner? Yes ✓ No ____

Are you currently a member of your lake association? Yes ✓ No ____

How many years have you been at the lake?
- 2 or less ____
- 2-5 years ____
- 5-10 years ____
- Over 10 years ✓

How do you use the lake (mark all that apply)

- ✓ Swimming
- ✓ Boating
- ___ Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ✓ No ____

Do you currently participate in a weed control project on the lake? Yes ✓ No ____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes sometimes No ____

Does the level of vegetation in the lake affect your property values? Yes ____ No ✓

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No ____

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes ✓ No ____

Mark any of these you think are problems on your lake:

- ✓ Too many boats access the lake
- ✓ Use of jet skis on the lake
- ___ Too much fishing
- ___ Fish population problem
- ___ Dredging needed
- ✓ Overuse by nonresidents
- ___ Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ✓ Pier/funneling problem

Please add any comments:

_____

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_____

Aquatic Plant Management Plan
Lake Use Survey for Bass Lake

Are you a lake property owner? Yes X No____

Are you currently a member of your lake association? Yes X No____

How many years have you been at the lake?

- 2 or less ___
- 2-5 years ___
- 5-10 years X
- Over 10 years ___

How do you use the lake (mark all that apply)

- X Swimming
- ✓ Boating
- X Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes X No____

Do you currently participate in a weed control project on the lake? Yes X No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes X No____

Does the level of vegetation in the lake affect your property values? Yes____ No X

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes X No____

Mark any of these you think are problems on your lake:

- X Too many boats access the lake
- ___ Use of jet skis on the lake
- ___ Too much fishing
- ___ Fish population problem
- X Dredging needed
- X Overuse by nonresidents
- ___ Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

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Aquatic Plant Management Plan
Lake Use Survey for Bass Lake

Are you a lake property owner? Yes ✓ No ____

Are you currently a member of your lake association? Yes ✓ No ____

How many years have you been at the lake?
- 2 or less ___
- 2-5 years ___
- 5-10 years ✓
- Over 10 years ___

How do you use the lake (mark all that apply)
- ✓ Swimming
- ✓ Boating
- ✓ Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ✓ No ____

Do you currently participate in a weed control project on the lake? Yes ✓ No ____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ✓ No ____

Does the level of vegetation in the lake affect your property values? Yes ____ No ✓

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No ____

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- ✓ Too many boats access the lake
- ✓ Use of jet skis on the lake
- ___ Too much fishing
- ___ Fish population problem
- ___ Dredging needed
- ✓ Overuse by nonresidents
- ✓ Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

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_____

Aquatic Plant Management Plan
Lake Use Survey for Bass Lake

Are you a lake property owner? Yes X No____

Are you currently a member of your lake association? Yes X No____

How many years have you been at the lake?
- 2 or less ___
- 2-5 years ___
- 5-10 years ___
- Over 10 years X

How do you use the lake (mark all that apply)
- X Swimming
- X Boating
- ___ Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes X No____

Do you currently participate in a weed control project on the lake? Yes X No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes____ No X

Does the level of vegetation in the lake affect your property values? Yes X No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes X No____

Mark any of these you think are problems on your lake:
- X Too many boats access the lake
- ___ Use of jet skis on the lake
- ___ Too much fishing
- ___ Fish population problem
- X Dredging needed
- ___ Overuse by nonresidents
- X Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

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_____

Aquatic Plant Management Plan
Lake Use Survey for Bass Lake

Are you a lake property owner? Yes ✓ No ____

Are you currently a member of your lake association? Yes ✓ No ____

How many years have you been at the lake?

- 2 or less ____
- 2-5 years ____
- 5-10 years ____
- Over 10 years ✓

How do you use the lake (mark all that apply)

- ✓ Swimming
- ✓ Boating
- ___ Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ____ No ✓

Do you currently participate in a weed control project on the lake? Yes ✓ No ____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ✓ No ____

Does the level of vegetation in the lake affect your property values? Yes ✓ No ____

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No ____

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes ✓ No ____

Mark any of these you think are problems on your lake:

- ___ Too many boats access the lake
- ✓ Use of jet skis on the lake
- ___ Too much fishing
- ___ Fish population problem
- ___ Dredging needed
- ___ Overuse by nonresidents
- ✓ Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

_____

_____

Aquatic Plant Management Plan
Lake Use Survey for Bass Lake

Are you a lake property owner? Yes ✓ No ____

Are you currently a member of your lake association? Yes ✓ No ____

How many years have you been at the lake?
- 2 or less ____
- 2-5 years ____
- 5-10 years ____
- Over 10 years ✓

How do you use the lake (mark all that apply)
- ✓ Swimming
- ✓ Boating
- ✓ Fishing
- ____ Irrigation
- ____ Drinking water
- ____ Other SUNSET

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ____ No ✓

Do you currently participate in a weed control project on the lake? Yes ____ No ✓

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ✓ No ____

Does the level of vegetation in the lake affect your property values? Yes ____ No ✓

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No ____

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes ____ No ✓

Mark any of these you think are problems on your lake:
- ____ Too many boats access the lake
- ✓ Use of jet skis on the lake
- ____ Too much fishing
- ____ Fish population problem
- ____ Dredging needed
- ____ Overuse by nonresidents
- ____ Too many aquatic plants
- ____ Not enough aquatic plants
- ____ Poor water quality
- ✓ Pier/funneling problem ?

Please add any comments:

Pumps 8 hours daily in use needs to be increased thru out the year, not just in mid summer.

Aquatic Plant Management Plan
Lake Use Survey for Bass Lake

Are you a lake property owner? Yes____ No X

Are you currently a member of your lake association? Yes____ No X

How many years have you been at the lake?
- 2 or less ___
- 2-5 years ___
- 5-10 years ___
- Over 10 years X

How do you use the lake (mark all that apply)
- X Swimming
- X Boating
- ___ Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes____ No X

Do you currently participate in a weed control project on the lake? Yes X No ~~X~~

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes X No____

Does the level of vegetation in the lake affect your property values? Yes____ No X

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes X No____

Mark any of these you think are problems on your lake:
- X Too many boats access the lake
- ___ Use of jet skis on the lake
- ___ Too much fishing
- ___ Fish population problem
- ___ Dredging needed
- ___ Overuse by nonresidents
- ___ Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

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APPENDIX II

VEGETATION CONTROL PERMIT

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R4 / 2-04)
Approved State Board of Accounts 2004

☐ Whole Lake ☒ Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to:
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name	Lake Assoc. Name	
Cinndi Carey	Bass Lake Conservancy District	
Rural Route or Street: 3620 South County Road 210		Phone Number: (574) 772-5794
City and State: Knox, IN		ZIP Code: 46534
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake)	Nearest Town	County
Bass Lake	Knox	Starke
Does water flow into a water supply		☐ Yes ☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area # A (2.5 acres)		LAT/LONG or UTM's Lat: 41.23883 Lon: -86.58425	
Total acres to be controlled: sum of 20 acres for lake		Proposed shoreline treatment length (ft): sum of 2,285 ft	Perpendicular distance from shoreline (ft): adjacent
Maximum Depth of Treatment (ft): 5 ft		Expected date(s) of treatment(s): 03/15/08 - 08/15/08	

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control.

There are four Eurasian watermilfoil priority treatment areas for Bass Lake in 2008. The 20 acres will be treated with a systemic herbicide application of 2,4-D or Renovate in 2008. Selected treatment locations for Eurasian watermilfoil are shown in the attached Eurasian watermilfoil priority treatment exhibit.

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify) Based on Tier II sampling conducted during August 2007

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Chara		13
Eurasian watermilfoil	x	9
Curlyleaf pondweed		5
Yellow water lily		2

Treatment Area #	B (3 acres)	LAT/LONG or UTM's	Lat: 41.23343 Lon:-86.58616		
Total acres to be controlled	sum of 20 acres for lake	Proposed shoreline treatment length (ft)	sum of 2,285 ft	Perpendicular distance from shoreline (ft)	adjacent
Maximum Depth of Treatment (ft)	5 ft	Expected date(s) of treatment(s)	03/15/08 - 08/15/08		

Treatment method: [x] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. same as previously stated on page 1

Plant survey method: [x] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2007

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Chara		13
Curlyleaf pondweed		4
Eurasian watermilfoil	x	2
Yellow water lily		2

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

[ ] Approved [ ] Disapproved	Fisheries Staff Specialist
[ ] Approved [ ] Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204

Treatment Area # C (4.5 acres)	LAT/LONG or UTM's Lat: 41.22489 Lon: -86.598		
Total acres to be controlled: sum of 20 acres for lake	Proposed shoreline treatment length (ft): sum of 2,285 ft	Perpendicular distance from shoreline (ft): 204 ft	
Maximum Depth of Treatment (ft): 10 ft	Expected date(s) of treatment(s): 03/15/08 - 08/15/08		

Treatment method: [x] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. same as previously stated on page 1

Plant survey method: [x] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2007

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	x	21
Chara		6
Curlyleaf pondweed		3

Treatment Area # D (10 acres)	LAT/LONG or UTM's Lat: 41.21553 Lon: -86.59604		
Total acres to be controlled: sum of 20 acres for lake	Proposed shoreline treatment length (ft): sum of 2,285 ft	Perpendicular distance from shoreline (ft): 1,125 ft	
Maximum Depth of Treatment (ft): 10 ft	Expected date(s) of treatment(s):		

Treatment method: [x] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. same as previously stated on page 1

Plant survey method: [x] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2007

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	x	21
Chara		6
Curlyleaf pondweed		3

APPENDIX III

RESOURCES FOR AQUATIC VEGETATION MANAGEMENT

Appendix III - Resources for

Aquatic Vegetation Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

Watershed Protection and Flood Prevention Program (USDA

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)

Bring Back the Natives Program (U.S. Fish and Wildlife Service)

Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)